Motor Vehicle Crashes Occurring on State Route 70 within the San Carlos Apache Reservation, 1985–1987.

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Motor vehicle crash-related morbidity and mortality is a major public health problem in the United States.[1] Native Americans have the highest unintentional injury rate and the highest motor vehicle fatality rate among all racial groups in the US population.[2]

"Accidents" are the second leading cause of death in the Phoenix Area of the Indian Health Service.[3] In the San Carlos Service Unit of the Phoenix Area, injuries are the third leading cause of clinic visits, and motor vehicle accidents are the fifth leading cause of injuries.[4] Although motor vehicle related injuries are not the most frequent type of injuries seen, they are generally the most severe and costly injuries treated at the San Carlos PHS Hospital.

Of the 250 documented motor vehicle crashes occurring on the San Carlos Apache Reservation from 1985 to 1987, 118 (47.2%) occurred on Arizona State Road US 70. In the same time period, 48.5% of the injury- and fatality-producing crashes on the reservation occurred on US 70.

The purpose of this study was to (1) identify and describe the motor vehicle crashes occurring on US 70 within the San Carlos Apache Reservation; (2) identify clusters of crashes; and (3) recommend intervention strategies designed to reduce or eliminate the identified crash clusters.

METHODS

All motor vehicle crashes occurring within the roadway of US 70 and the boundaries of the San Carlos Apache Reservation from January 1, 1985 through December 31, 1987 were represented in this study. The crash cases were identified by reviewing and documenting motor vehicle crash cases reported in the records of the San Carlos Apache Tribal Police Department; Arizona Department of Transportation, Traffic Records Section; San Carlos Emergency Medical Services; and San Carlos PHS Hospital. Motor vehicle crashes identified from these sources were cross-referenced by location, date, time, and number of victims to eliminate duplicate cases.

Crash cases identified were recorded on the Arizona Department of Transportation form 01-2704 5. The data was analyzed through use of the Epi Info Version 3 computer programs. Investigations of location clusters were conducted.

Several limitations were accepted in conducting the study. The data sources used did not have identical reporting techniques, so the amount and accuracy of information from some sources were more complete than others. Some minor or less severe motor vehicle crashes were most likely under-reported because the drivers did not report them or left the crash site before the data sources used could document the crash. Some roadway modifications and improvements may have occurred that would change the crash patterns but were too recent to be detected by the study.

RESULTS

The study represents 118 crashes on the 44 miles of US 70 within the San Carlos Apache Reservation. Of the 118 crashes, 59% were single-vehicle and 35% were multiple-vehicle crashes. The crashes involved a total of 158 traffic units that resulted in 7 fatalities and 98 injuries. Males were involved as drivers or pedestrians 69% of the time.

A. Location - Of the 118 crashes, 55 (46.6%) were clustered within three sections of roadway approximately three miles in length each. Each of the clusters is associated with the three population centers of the reservation.

> 1. Western Cluster - This cluster contains 13 (11%) of the total crashes and extends from milepost (MP) 257.5 to MP 260.0. This cluster is located within the main route of travel from the communities of San Carlos and Globe. A road side rest area with uncontrolled access is located on the south side of MP's 257.5-257.7. The junction for traffic traveling on BIA Route 6 to San Carlos is located at MP 260.0. This is a two-lane, level, straight, undivided roadway with a left-turn lane at MP 260.0. Visibility is unobstructed through

the section. The speed limit in this section of roadway is 55 mph. A small airport, an abandoned sawmill, and a few homes are located along MP's 259.8-259.9, the rest of the section is bordered by open range. Most typical collisions in this section were multiple-vehicle (30.8%), followed by animal (23.1%) and fixed object (23.1%) collisions.

2. Peridot Cluster - This is the largest cluster containing 29 (24.6%) of the total crashes. It is located in the middle of the reservation where US 70 passes through the community of Peridot. The section starts at MP 271.0, which is the intersection of US 70 and US 170, continues across the San Carlos River Bridge, through the community of Peridot and ends just east of Peridot at MP 273.2. This is a straight, two-lane, undivided roadway, with a 45-mph speed limit. The shoulders along this section of roadway are narrow and lined by guard rail. The roadway is cut through a hillside at one location. Visibility is limited throughout much of the section because of hilly topography.

One location within the cluster, MP 272.5, accounted for 7.6% (9) of the crashes in the study. This location is the junction of the only paved access roads serving two large housing developments to the north and south of US 70.

The most common type of collision in this section was multiple vehicle (46.7%) followed by animal collisions (20%).

3. Bylas Cluster - This cluster contains 13 (11%) of the crashes in the study. It is located on the east end of the reservation where US 70 enters the community of Bylas. The section starts at MP 294.0 where the speed zone starts on the west end of Bylas and continues through the community to MP 296.1, just past the trading post at the east end of Bylas. The speed limit in this section of roadway is 45 mph. This is a two-lane roadway that is divided for the first 0.7 miles. Houses line both sides of the roadway throughout the section but are separated from the road by a wide shoulder on both sides. The road is level and straight throughout the section and there are no significant obstructions to visibility. The leading type of collision in the section was animal (38.5%) followed by multiple vehicle (30.7%) and pedestrian (15.4%). All of the animals involved in collisions were stray horses.

4. Other locations - Collisions occurring outside the cluster areas were typically fixed-object, rollover, and other-type collisions. The speed limit along these stretches of road is 55-mph, but traffic often travels considerably faster. The roadway is bordered by undeveloped open range. This section of roadway is two-lane, undivided and includes one left turn lane and two short passing lanes.

B. Type and Severity of Collision - The 118 crashes fell into six types of collisions: multiple-vehicle, 31; fixed object, 26; animal, 23; rollover, 16; pedestrian, 11; and other, 11. All types of collisions did not occur every location or result in the same types of injuries.

Multiple-vehicle crashes were intersection related and clustered around MP 272.5 in Peridot and along the roadside rest area by MP's 257.5-257.7. The slow speeds associated with most multiple vehicle crashes usually resulted in low injury rates. 9.7% of the multiple-vehicle collisions resulted in fatalities. This was a result of slow moving local traffic from the residential areas of Peridot entering US 70 where the visibility is obstructed and the cross-traffic is traveling at speeds often greater than 60 mph.

Pedestrian collisions occurred in the two community areas in the study, Peridot and Bylas. There are no sidewalks, crosswalks, or lights to illuminate the roadway at night in the communities. The road shoulder in Peridot is narrow in many locations and the San Carlos River Bridge does not have a walkway designed for pedestrian travel.

Collisions with animals occurred throughout the study area but peaked in Peridot and Bylas. This is attributed to the open range laws on the reservation combined with gates left open along range land. Animal collisions in the communities is a result of a large number of stray livestock that roam as strays in the communities.

Fixed-object and rollover are similar types of collisions. They were distributed evenly throughout the study area. These were usually single-vehicle collisions associated with drivers falling asleep at the wheel and/or drinking.

The other collision category was minor run-off road collisions where the vehicle did not strike a fixed object or rollover. As would be expected they resulted in no injuries or minor injuries.

C. Population - Drivers in the 20-29 years of age group were most frequently involved in collisions. Male drivers out-numbered females by 2 to 1. Reservation residents were involved in collisions more often than off-Reservation and out-of-state residents.

D. Vehicle - The most common type of vehicle involved in collisions was pickup trucks followed by sedans. Most of the vehicles involved in collisions were over five years old.

E. Time - Most of the crashes were associated with weekend driving. 8.5% of the crashes occurred during the hour of 7 p.m. and 38.5% occurred between the hours of 6 p.m. and midnight. Summer (37.2%) led all other seasons, and August had the most collisions, 19.

F. Source of data - The San Carlos Police Department was the primary reporting source of the motor-vehicle crash cases.

DISCUSSION

Several study findings confirmed some standing beliefs about motor-vehicle crash trends on the San Carlos Apache Reservation. Other information revealed in the study gave an insight into methods for reducing the types and numbers of collisions on the Reservation.

The over-representation of males and young drivers matches closely with national statistics. The higher percentage of weekend, late night, and summer collisions is also similar to national statistics. The type and age of the vehicles involved in collisions were close to expectations.

Analysis of the types of collisions and where they occurred reveal some information that may be used to reduce their incidence or severity:

Peridot Cluster: This location leads the study in the total number of crashes and the number of multiple-vehicle collisions. It contains the location with the single highest crash incidence (MP 272.5) and has a high number of pedestrian and animal collisions. The problems in this section appears to be the combined result of (1) a large population increase in the last few years following the construction of the 800 unit Moonbase and Hollywood Ridge HUD development north of MP 272.5; (2) increased business development that went along with the population growth, (3) slower moving vehicles from the residential areas entering the faster moving traffic on US 70, and (4) no significant roadway improvement designed to handle the increased growth in the area.

There is only one access road from the Moonbase and Hollywood Ridge development. This road splits just before US 70 and intersects at MP's 272.5 and 272.8. Moonbase and Hollywood Ridge generate a large percentage of local traffic going to and from San Carlos. Most of this traffic uses the intersections located at MP 272.0 (Peridot Sideing Road) or MP 271.2 (US 170).

The San Carlos Apache Tribe is currently in the final planning stages of constructing a high school south of US 70 at MP 270.7. When this school is opened there will undoubtably be housing and business development and increased motor vehicle and pedestrian travel along US 70. It is not difficult to estimate the increase of traffic and pedestrian travel along US 70 as a result of the high school opening. To the knowledge of the author, there has been no discussion of improving or modifying US 70 to compensate for the increased traffic pressures.

Peridot Cluster Recommendations: The tribe should consider prioritizing and seeking funding to:

1. Provide an access road from the back of the Moonbase development to Peridot Sideing Road. This would eliminate a significant percentage of the traffic flow entering US 70 at MP 272.5 and MP 272.
2. Improve and upgrade US 70 through Peridot to a four-lane divided roadway.
3. Provide a walkway designed for pedestrians across the San Carlos River Bridge.
4. Reduce the speed limit in Peridot and enforce the speed limit. Install rumble strips in the roadway to warn drivers approaching Peridot on US 70 that they are entering a speed zone.

5. Lower the hillsides along the road at MP 271.9 and 272.3-272.4 to increase visibility.
6. Provide roadway lighting along US 70 through Peridot to increase visibility at night and help reduce pedestrian and animal collisions.

Bolas Cluster: 46% of the collisions in this area were animal- and pedestrian-associated and occurred at night.

Bolas Cluster Recommendations: The tribe should consider the following measures to reduce the number of collisions in the area:
1. Provide roadway lighting along US 70 through Bylas to increase visibility at night and help reduce pedestrian and animal collisions.
2. Adopt a program to impound stray livestock in community areas on the reservation.
3. Require cattle guards at the entrance to range land that borders the highway.

Western Cluster: 30.8% of the collisions in this area were multiple vehicle associated with the intersection with BIA Route 6 at MP 260 and the roadside rest area south of MP 257.5. Within the last year the turn lane to BIA Route 6 was improved. It is too soon to tell what effect this has had on the crash pattern in the area.

Western Cluster Recommendations: The tribe should consider requesting ADOT to redesign the roadside rest area to channel and restrict access to the rest area.

Other Locations: The most common types of collision in the roadways outside the cluster areas are single-vehicle crashes that result in rollovers or collisions with fixed objects. These types of collisions are associated with inattention, fatigue, and/or alcohol impairment. Combine these conditions with the long stretches of open road on the reservation and it is not hard to see how these types of collisions occur. It is impractical to expect that every site where one of the crashes has occurred can be eliminated, but there are some methods that can be effective in reducing these types of collision. The installation of rumble strips along the shoulder are effective in alerting a driver that the vehicle has drifted off the roadway, and the installation of guard rails is effective in keeping vehicles away from significant roadside hazards. In the past year rumble strips and stretches of guard rail were installed along the roadway from MP 271.7's 275.5. It is too soon to tell what effect this has had on the crash pattern in the area.

Other Location Recommendations: The tribe should consider requesting that ADOT prioritize more sections of US 70 for the installation of rumble strips and guard rail.

Other General Recommendations: The speed of a motor vehicle entering a collision has a large bearing on the severity of the injuries that result from the crash. There is little to no enforcement of the speed limits along US 70 on the Reservation. This can be attributed to many factors, but the most commonly sited is the lack of staffing and funding at the San Carlos Police Department. At one time, the Arizona Department of Public Safety (DPS) patrolled this stretch of US 70. Due to sovereignty issues of jurisdiction on reservation land, DPS was asked to stop patrolling US 70 on the Reservation. With staffing shortages at the tribal police department and public health concern over motor vehicle fatalities and injuries, the Tribal Council should consider re-evaluating this decision.